IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

PATENT

In re application of: RICCI et al.

Application No.: 09/408,921

Filed: September 30, 1999

Title: PRETREATED GAS DISTRIBUTION PLATE

Attorney Docket No.: LAM1P118/P0539

Examiner: BUEKER, Richard R.

Group: 1763

DECLARATION UNDER 37 CFR § 1.132

Assistant Commissioner for Patents
Washington, D.C. 20231

Sir:

I, Anthony Ricci, declare as follows:

I am a co-inventor in the above-identified patent application with Babak Kadkhodayan.

I am a citizen of the United States of America.

I received a B S degree from Cornell University in Electrical Engineering. I also have a Master's degree from Cornell University in Electrical Engineering.

I have worked for Lam Research Corporation from 1996 doing research in semiconductor fabrication technology. Previously, I had been employed by IBM Corporation from 1984 to 1996 as a semiconductor equipment and process engineer responsible for advanced integrated circuit fabrication development; including an assignment to industry consortium SEMATECH that involved management of state-of-the-art projects with IC fabrication and process equipment companies.

I have reviewed the patent US. Patent No. 5,746,875 to Maydan et al (Maydan), US Patent No. 6,083,451 to Gupta et al. (Gupta), US Patent No. 5,993,594 to Wicker et al. (Wicker I), and US Patent No. 5,824,605 to Chen et al. (Chen).

Our invention addresses a method of eliminating particulate defects, generated from the surface of the showerhead or gas distribution plate (GDP) surface. This is

done by removing a layer of damage incurred during the process of forming this surface. The machining of ceramic materials to achieve required dimensions or shapes induces a physical weakening of the surface which, when interacting with plasma chemistry of the type used to process semiconductors, generates large numbers of particulate defects that are incompatible with the intended application. Our tests have found that the inventive process substantially eliminates particles of a size greater than or equal to 0.2 microns in diameter.

Maydan mentions polishing as a method of eliminating defects on the surface of the part. We performed tests to see if we could use polishing to eliminate the particulate contamination from machined ceramic-like surfaces. In our work, we lapped the part to a very fine surface finish, yet measured high particle densities. Our research concluded that polishing would not eliminate the fundamental problem that results in particulate contamination from machined ceramic-like surfaces, as it will still impart surface damage. The particles that we were required to measure were of a size greater than or equal to 0.2 microns in diameter, and studies on polished samples of silicon nitride indicated that defect levels of this size were not significantly improved and therefore were not substantially eliminated.

Regarding Gupta (6,083,451), even if the part is sintered at high temperatures, 1400 to 1700 deg. C to generate larger ceramic grain size and a more etch resistant surface, according to our research, subsequent machining of the part will generate high levels of particulate caused by the weakening and damage of that surface by the machining process.

Wicker I (5,993,594) describes the silicon nitride embodiment of a GDP. Wicker I describes taking a powder, forming the powder into a shape and then sintered to form the GDP. We would subsequently machine the GDP to form the GDP into a desired shape and to provide holes. Our research indicated that subsequent machining the GDP of Wicker I would cause micro-defects, which would create contaminants. Therefore, the invention adds an additional annealing to the GDP of Wicker I, after machining the GDP, to remove the micro-defects.

The patent of Chen, et.al. (5,824,605) discusses an aluminum oxide GDP concept and mentions a fabrication method whereby the surface shape is formed prior to sintering, which is done at high temperatures. The sintering process temperature is coincidentally near that of the annealing temperature claimed in our invention; however, sintering is a different process than annealing.

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true. I further declare that these statements are made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both (under Section 1001 of Title 18 of the United States Code), and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

Anthony Ricci

June 5, 2003

Date